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| 30678 7590 02/20/2008<br>CONNOLLY BOVE LODGE & HUTZ LLP<br>1875 EYE STREET, N.W.<br>SUITE 1100<br>WASHINGTON, DC 20036 |             |                      | EXAMINER<br>SMITH, NICHOLAS A |                        |
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**BEFORE THE BOARD OF PATENT APPEALS  
AND INTERFERENCES**

Application Number: 10/615,794  
Filing Date: July 10, 2003  
Appellant(s): ANDRICACOS ET AL.

\_\_\_\_\_  
Donald K. Drummond  
For Appellant

**EXAMINER'S ANSWER**

This is in response to the appeal brief filed 19 November 2007 appealing from the Office action mailed 24 May 2007.

**(1) Real Party in Interest**

A statement identifying by name the real party in interest is contained in the brief.

**(2) Related Appeals and Interferences**

The examiner is not aware of any related appeals, interferences, or judicial proceedings which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

**(3) Status of Claims**

The statement of the status of claims contained in the brief is correct.

**(4) Status of Amendments After Final**

The appellant's statement of the status of amendments after final rejection contained in the brief is correct.

**(5) Summary of Claimed Subject Matter**

The summary of claimed subject matter contained in the brief is correct.

**(6) Grounds of Rejection to be Reviewed on Appeal**

The appellant's statement of the grounds of rejection to be reviewed on appeal is correct.

**(7) Claims Appendix**

The copy of the appealed claims contained in the Appendix to the brief is correct.

**(8) Evidence Relied Upon**

|           |                 |        |
|-----------|-----------------|--------|
| 6881319   | SEITA ET AL.    | 4-2005 |
| 6,569,307 | BLACHIER ET AL. | 5-2003 |

|               |                |        |
|---------------|----------------|--------|
| 6,083,374     | KOPP           | 7-2000 |
| 20002/0125142 | SUN ET AL.     | 9-2002 |
| 2004/0108213  | TALASEK ET AL. | 6-2004 |

Skoog et al., Fundamentals of Analytical Chemistry 7th Edition; Saunders College Publishing, Fort Worth, 1996, Pgs. 701-703 and 708-709

### **(9) Grounds of Rejection**

The following ground(s) of rejection are applicable to the appealed claims:

Claims 16-20 and 24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Seita et al. (US Patent 6,881,319) in view of Blachier et al. (US Patent 6,569,307), further in view of Kopp (US Patent 6,083,374) and further in view of Sun et al. (US 2002/0125142).

Regarding claim 16, Seita et al. teach a method for controlling the composition of a copper plating bath comprising:

- providing plating bath and obtaining an aliquot, i.e., a bath liquor (column 3, lines 14- 30 and column 4, lines 64-67)
- determining the concentration of an accelerator byproduct, referred to as  $-X-S^-$  (column 4, lines 60-64). This is equivalent to the claimed "void formation marker" as defined in applicant's specification.
- maintaining the VFM concentration below a certain threshold level (column 5, lines 56-67).

However, in regards claimed features "counting, for each of said time-points, the number of voids in the metal plated on said substrate" and determining said threshold

VFM concentration as the largest VFM concentration at which no voids are observed, Seita et al. does not specifically teach counting the number of voids and setting the acceptable range (or threshold value) for the byproduct concentration according to the number of voids.

Blachier et al. teach a method for plating objects wherein certain aspects of the plating process are monitored in order to maintain the byproduct concentration below a predetermined value. In one embodiment, the degree of void-free plating is measured, which is equivalent to counting the number of voids (column 7, lines 49-61). It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the method of Seita et al. by counting the number of voids as taught by Blachier et al., and using this value to determine the threshold value, because Blachier et al. teach that monitoring this aspect provides an indication of the condition of the plating substances (column 7, lines 62-64).

However, Seita et al. in view of Blachier et al. do not teach performing a bleed and feed to maintain the VFM concentration below the threshold value.

Kopp teaches a method for maintaining a constant concentration of plating bath components wherein a portion of the plating bath is periodically removed and replenished with fresh solution (see abstract). The volume of solution removed is equal to the volume added (column 3, lines 46-51). It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the method of Seita et al. in view of Blachier et al. by incorporating a bleed and feed step as taught by Kopp,

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because Kopp teaches that removal of the solution containing decomposition products leads to an extension in the serviceable life of the bath (column 3, lines 25-35).

Examiner notes that Seita et al. in view of Blachier et al. and further in view of Kopp does not specifically teach a step of measuring the bath concentration of said at least an accelerator.

Sun et al. discloses a method of measuring the bath concentration of said at least an accelerator in an electrochemical plating process (paragraphs [0006] and [0009]). It would have been obvious to one of ordinary skill in the art to modify Seita et al. in view of Blachier et al. and further in view of Kopp's method with a step of measuring accelerator concentration in order to perform optimal and controllable plating (Sun et al., paragraphs [0006]-[0009]). Furthermore, it is noted that such a step of measuring accelerator concentration would be inherently done at a plurality of time-points in order to monitor the process (Sun et al, paragraphs [0006]-[0009]).

Seita et al. in view of Blachier et al., further in view of Kopp and further in view of Sun et al. expressly teaches all elements of claim 16 except the following: There is no express mention of a VFM ratio as claimed and the process is not expressly maintained at a VFM threshold ratio, in that the above combination teaches in terms of VFM concentration and VFM threshold. Examiner notes that steps of determining VFM ratio and VFM threshold ratio are performed inherently in that the measurements necessary to determine (or to calculate) the VFM ratio and VFM threshold ratio are taught in the above combination. A mathematical calculation (determining) is not a patentable designation and therefore the prior art inherently teaches such determination steps.

Furthermore, Seita et al. in view Blachier et al., further in view of Kopp and further in view of Sun et al. teaches maintaining the VFM concentration below a VFM concentration threshold. Given that performing bleed and feed of a plating bath is designed to keep accelerator concentrations constant (Kopp, abstract), maintenance of a VFM concentration below a VFM concentration threshold would be inherently equivalent to maintenance of a VFM ratio below a VFM threshold ratio under conditions wherein the accelerator concentrations are maintained to be substantially constant.

Regarding claim 17, Seita et al. teach that determining the concentration comprises separating the VFM from the solution and quantifying it (column 4, lines 60-64). Although these steps are not expressly recited, they are inherent to the process of measuring a concentration by high speed liquid chromatography.

Regarding claims 18-20, Seita et al. teach that the VFM is separated by high speed liquid chromatography (column 4, lines 60-64). This technique is synonymous with high performance liquid chromatography (HPLC).

Regarding claim 24, HPLC would inherently provide a quantitative output in proportion to the concentration of VFM. Specifically, HPLC provides a chromatogram consisting of a series of peaks corresponding to different analytes. The area under a peak is integrated to obtain the concentration of the analyte.

Claim 21 is rejected under 35 U.S.C. 103(a) as being unpatentable over Seita et al. in view of Blachier et al., further in view of Kopp and further in view of Sun et al. as stated above in regards to claim 18, and further in view of Skoog et al. (*Fundamentals*

*of Analytical Chemistry* 7<sup>th</sup> Ed.; Saunders College Publishing, Forth Worth, **1996**, pp. 701-702 and 708-709).

Seita et al. in view of Blachier et al., further in view of Kopp and further in view of Sun et al. teach the features as previously described. However this reference does not teach that the method of chromatography is ion-pairing, reversed-phase chromatography.

Skoog et al. teach that reversed phase liquid chromatography is a subset of high performance liquid chromatography (see Figure 30-2 and pp 708-709). Furthermore, the term "ion pairing" refers to the solvent system used in the HPLC and thus is merely describing the chromatography conditions. It would have been obvious to one of ordinary skill in the art at the time of the invention to select reversed phase chromatography from the broader category of HPLC taught by Seita et al., because Skoog et al. teach that the eluent for this technique are aqueous solutions, which is advantageous to using pure organic solvents (pg 709).

Claims 22-23 are rejected under 35 U.S.C. 103(a) as being unpatentable over Seita et al. in view of Blachier et al., further in view of Kopp and further in view of Sun et al. as stated above in regards to claim 17, and further in view of Talasek et al. (US2004/0108213).

Seita et al. in view of Blachier et al., further in view of Kopp and further in view of Sun et al. teach the features previously described. However, this reference combination does not teach that the quantifying is performed by spectroscopy or electrochemical deposition.



Talasek et al. teach a method for controlling the composition of a plating bath wherein the amount of additive breakdown byproduct is measured by optical or electrochemical techniques (paragraph 29 and paragraph 38). Regarding claim 8, an optical technique would comprise ultraviolet, visible, and infrared spectroscopy. It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the method of Seita et al. in view of Blachier et al., further in view of Kopp and further in view of Sun et al. by using optical or electrochemical techniques to quantify the VFM concentration as disclosed by Talasek et al., because Talasek teaches that these methods allow direct real-time detection of byproducts (paragraph 49).

Claims 25-26 are rejected under 35 U.S.C. 103(a) as being unpatentable over Seita et al. in view of Blachier et al., further in view of Kopp and further in view of Sun et al. as stated above in regards to claim 16, and further in view of Kopp.

Seita et al. in view of Blachier et al., further in view of Kopp and further in view of Sun et al. teach the features as previous described.

Regarding claims 25 and 26, it would have been obvious to one of ordinary skill in the art at the time of the invention to optimize the fractional volume of the bath which is replaced, because Kopp teaches that the quantity of solution replaced should be adapted to the specific plating parameters (column 3, lines 36-45).

#### **(10) Response to Argument**

Appellant argues:

The claimed process of controlling a plating bath by operating below a threshold void formation marker (by-product or VFM) ratio provides for an improvement over prior

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art methods of operating a plating bath by controlling a single variable of either the starting additive or the by-product resulting from plating. Control of the plating bath by the VFM ratio is different than controlling the bath to a given VFM or a given acceleration component concentration (C) because the claimed process allows individual variance of VFM and of C and that the VFM ratio is a relative number that does not require these two concentrations to be individually set. Appellant contends that prior art combination requires elimination of Seita et al.'s step of adding a thiol-reactive compound to neutralize a deleterious decomposition product of a sulfur-containing compound and therefore makes prior art combination inoperable.

Examiner answers:

While Seita et al. in view of Blachier et al., further in view of Kopp and further in view of Sun et al. do not expressly teach a VFM ratio as claimed and the process is not expressly maintained at a VFM threshold ratio, it is noted that in that the above combination teaches in terms of VFM concentration and VFM threshold. Examiner notes that steps of determining VFM ratio and VFM threshold ratio are performed inherently in that the measurements necessary to determine (or to calculate) the VFM ratio and VFM threshold ratio are taught in the above combination. A mathematical calculation (determining) is not a patentable designation and therefore the prior art inherently teaches such determination steps. Furthermore, Seita et al. in view Blachier et al., further in view of Kopp and further in view of Sun et al. teaches maintaining the VFM concentration below a VFM concentration threshold. Given that performing bleed and feed of a plating bath is designed to keep accelerator concentrations constant

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(Kopp, abstract), maintenance of a VFM concentration below a VFM concentration threshold would be inherently equivalent to maintenance of a VFM ratio below a VFM threshold ratio under conditions wherein the accelerator concentrations are maintained to be substantially constant. It is noted that while the claimed invention of controlling by VFM ratio allows for individual variance of either VFM or C, that, the prior art combination meets the claimed language of "maintaining said VFM ratio below said VFM threshold ratio" in that prior art's combination of having a constant VFM and a constant C would maintain the VFM ratio of the bath below a VFM threshold ratio, and, that, individual variance of VFM or C is not required in the instantly claimed invention. Furthermore, modifications to primary reference, Seita et al. do not require the elimination of a step of adding a thiol-reactive compound to neutralize a deleterious decomposition product of a sulfur-containing compound, and, therefore, the prior combination would be expected to be a success.

**(11) Related Proceeding(s) Appendix**

No decision rendered by a court or the Board is identified by the examiner in the Related Appeals and Interferences section of this examiner's answer.

For the above reasons, it is believed that the rejections should be sustained.

Respectfully submitted,

/Nicholas A. Smith/

Examiner, Art Unit 1795

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